daily execution of tasks is managed by a multidisciplinary IPT. In addition to the functional disciplines, technical expertise from several Army activities is included to address munitions, sensors, command and control and communications technologies.

As a risk reduction measure and to maintain competition, two best-of-industry teams are currently in an IMS competitive development phase. This phase will culminate in a down selection based in large measure on integration into the FCS Family-of-Systems. To this end, each team is maximizing modeling and simulation within its respective System Integration Laboratory. Outputs from these will feed the FCS System-of-Systems Integration Lab.

The IMS, an integral part of FCS, will be delivered by multiple means and operate across the full spectrum of operations to provide immediate engagement and unattended area denial effects — scaleable nonlethal and lethal munitions that deny enemies the use of an area.

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FCS Spiral Development and the S&T Community

George J. Mitchell

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

The Program Manager (PM) Future Combat Systems (FCS) will use spiral development to bring forward subsystems and other enabling technologies that require maturation before inserting them into the system architecture. In the FCS Acquisition Decision Memorandum (ADM), the Under Secretary of Defense for Acquisition, Technology and Logistics (USDAT&L) addresses DOD's thrust with evolutionary acquisition and its goal to shorten development time for delivery of military capability. The use of a spiral development strategy for FCS is intended to deliver to the user desired capability sooner rather than waiting for a future increment. The ADM continues by stating that the "… program must remain flexible and open to accommodate [system] trades … with the objective of providing an effective, affordable, producible and supportable increment of military capability."

These statements from the USDAT&L are consistent with DoDI 5000.2, *Operation of the Defense Acquisition System*, which states that the goal of evolutionary acquisition (including spiral development) is to balance needs and available capability with resources. It further states that success of the strategy depends in part on the maturation of technologies.

To fold these systems into the FCS, the Program Management Office (PMO) was charged with crafting a strategy to spiral forward specific subsystems and technology opportunities into FCS Increment I. For PM FCS, the challenges associated with managing technologies and associated resources meant that the FCS architecture must be developed now to allow room for system growth and spiral insertion of the subsystems and technologies in the future. As technologies

mature, they must be developed to meet such limits as volume, weight and power and fulfill user performance requirements and Army cost targets. This effort requires continuous communication between the system designers, technology program managers and the user representatives.

Generally, the process for spiraling technology into the FCS, as described in the FCS Program Management Plan, conforms to the following steps:

• Identify potential payoff technology.
• Prepare incremental development plan for approval.
• Assess ability to incorporate with respect to technology maturity and program schedule.
• Prioritize against Army requirements.
• Resource.
• Plan production break-in point/retrofit plan.
• Execute plan for integration.

Again, not all technologies will be ready for integration when desired because of actual technical maturity and resource availability. As a result, the FCS program management team and

the U.S. Army Training and Doctrine Command (TRADOC), as part of the program review process, remain open to deferring requirements to later spiral opportunities or FCS increments.

To perform the mission of managing the spiral development process, a Spiral Development and Technology Planning Integrated Product Team (IPT) was formed as the FCS program entered into system development and demonstration (SDD). This PM FCS and Lead Systems Integrator (LSI) co-chaired IPT is made up of representatives from the U.S. Army Research, Development and Engineering Command (RDECOM); the TRADOC Unit of Action Mission Battle Lab and PM FCS, with input provided by the Deputy Assistant Secretary of the Army for Research and
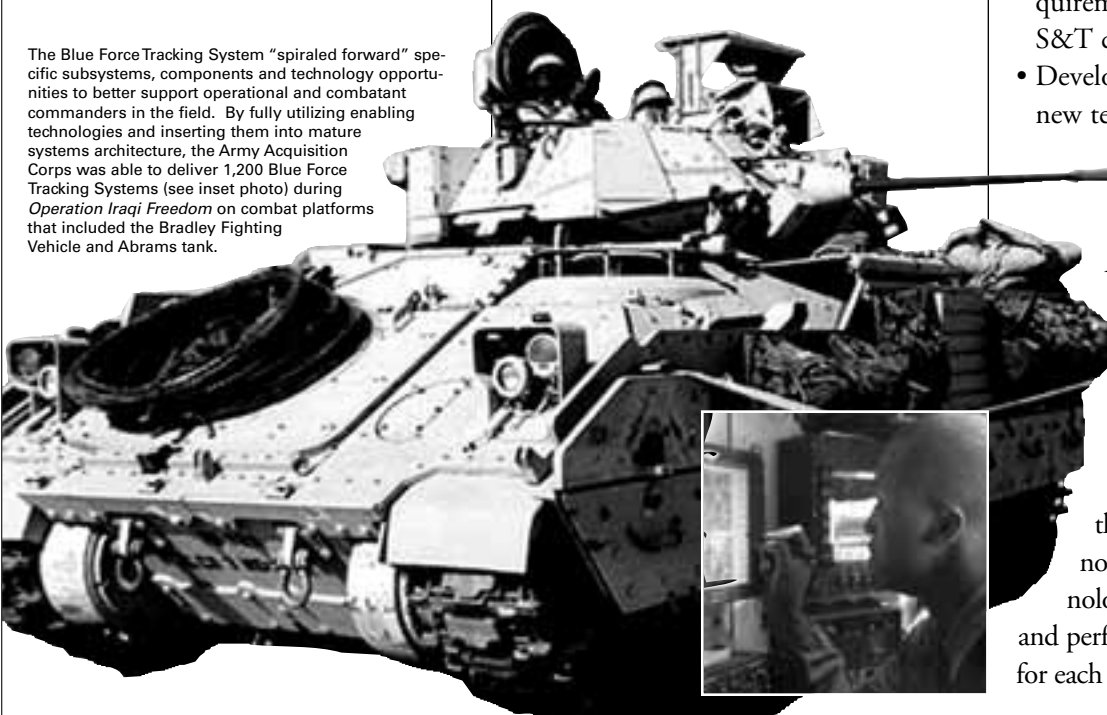
> As technologies mature, they must be developed to meet such limits as volume, weight and power and fulfill user performance requirements and Army cost targets. This effort requires continuous communication between the system designers, technology program managers and the user representatives.

Technology (DASAR&T), Army G-8, TRADOC Deputy Chief of Staff for Development and HQ RDECOM. The IPT also examines the possible integration of foreign-made technologies while focusing on the importance of interoperability between U.S. equipment and that of its potential allies. The responsibilities of the IPT include:

• Identify, evaluate, focus and recommend new technologies for insertion into FCS.
• Coordinate and support the process to identify and mature systems not currently in the FCS baseline until ready for transition.
• Coordinate the process of providing endorsements and recommendations to Army science and technology (S&T) management.
• Communicate FCS technical requirements and architectures to the S&T community.
• Develop analytical assessments of new technologies.
• Develop technology transition agreements.

A key IPT product is the program Technology Development Strategy (TDS) that is currently under development. This document — which will be modified throughout the life of the program — details how the program is divided into technology spirals, at what point technologies are planned for insertion and performance and test plan criteria for each technology spiral.

The Blue Force Tracking System "spiraled forward" specific subsystems, components and technology opportunities to better support operational and combatant commanders in the field. By fully utilizing enabling technologies and inserting them into mature systems architecture, the Army Acquisition Corps was able to deliver 1,200 Blue Force Tracking Systems (see inset photo) during *Operation Iraqi Freedom* on combat platforms that included the Bradley Fighting Vehicle and Abrams tank.

Technologies that support and provide desired FCS capabilities are pursued throughout the entire S&T community. From its beginning with technologies developed by the Defense Advanced Research Projects Agency, FCS has evolved into an Army program. FCS now relies heavily on Army S&T community efforts to bring technology to a desired maturity level for system integration. Additional technology sources include other Army and military programs, industry and academia. These S&T efforts result in both primary FCS components as well as enablers to the various program elements. Key to successful technology integration is the interaction between the S&T PM and the FCS IPT that is formalized within a technology transition agreement.

As previously stated, the technology maturity and the timing of reaching the desired technology readiness level of 6 or greater are important, and by necessity are, tied to the planned insertion point documented within the TDS. Evolving from TRADOC force operating capabilities and determined capability gaps, the S&T community creates developmental efforts and applies resources such that materiel fill to a capability gap is developed to meet desired program schedules.

An important process performed within the PMO is providing Army S&T management endorsements and recommendations to ongoing and planned research and development efforts. This process entails analysis of current and potential S&T efforts that might fulfill an FCS materiel need.

This is important because FCS requires the rapid maturation and integration of selected technologies throughout its evolutionary acquisition. For each technology opportunity, PM FCS assesses FCS architecture impact and architecture integration ability and examines technology affordability. This analysis ensures that all FCS technology is mature before insertion into the design of a particular FCS increment. This analysis is provided to the S&T community in the form of recommendations and potential endorsement of the effort.

PM FCS recommendations and endorsements are incorporated into management forums that are run by TRADOC and DASAR&T. These forums include Warfighter Technical Councils and Army S&T Working Group reviews. These reviews ultimately solidify a funded portfolio of technology projects for each fiscal year focused on identified capability gaps in the FCS program and other Army programs.

In summary, the key to PM FCS' technology management success is application of sound principles and processes, which include:

- Sustaining a collaborative relationship with the S&T community for future FCS concepts and technologies.
- Designing technology integration points into the evolutionary

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acquisition strategy or as part of an increment based on business case analysis.
- Testing promising technologies in relevant environments in coordination with the Army's Battle Labs.
- Assessing and developing risk-mitigation plans for higher risk technologies.
- Assessing producibility of technologies.
- Implementing the technology through deliberate integration points.

By thoroughly integrating these principles and processes as part of the spiral development strategy, PM FCS will be able to provide effective, affordable, producible and supportable military capability to combatant commanders ensuring greater lethality, survivability and sustainability on the battlefield than ever before.

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